

Hyperoxic Myopia: A Case Series of Four Divers

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IRB Oversight

- ▶ This research was conducted with collaboration from the Navy Experimental Diving Unit (NEDU).
- ▶ Test Plan # 14-11/40061 “Hyperoxic Myopia: A Case Series”
- ▶ NEDU IRB found the test plan to NOT be human subject research
- ▶ Funded by NAVSEA DSB DP N0002411WX02303

- ▶ **Hyperoxic myopia**
 - Occurs in individuals exposed to increased partial pressure of oxygen (PO_2)
 - Exposure leads to **myopic shift**
- ▶ Limited research performed on **dry patients** who were receiving hyperbaric oxygen for various conditions
- ▶ Prior to this case series, there are **only three** reported cases of hyperoxic myopia in **wet divers**
- ▶ This case series: **four wet divers** with hyperoxic myopia

Exposure to Hyperbaric Oxygen



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Hyperoxic myopia in a closed-circuit mixed-gas scuba diver

F. K. BUTLER, Jr, E. WHITE, and M. TWA 1999 *Undersea and Hyperbaric Medical Society, Inc.*

- ▶ Constant PO_2 1.3 atm
- ▶ 85 hours dive time over 18 days
- ▶ -1.50 diopters myopic shift
- ▶ Recovery in 3-4 weeks after exposure without intervention
- ▶ Lowering PO_2 to 1.2 atm and increased surface intervals did not prevent recurrence on a subsequent dive trip

- ▶ **FOUR DIVERS:**
- ▶ Two: Directly observed by author
- ▶ Two: Via record review
- ▶ All divers were interviewed to correlate subjective data with objective findings

Results

- ▶ Each diver was “fit for diving duty” as per the US Navy Manual of Medicine
- ▶ 5 days, 6 hours, PO₂ of 1.35 ATM (40.5 ATM-hrs)
 - 100% Oxygen at 12-14 feet deep
 - Open circuit surface supplied 100% oxygen
- ▶ Visual Acuity was measured before the diving series
- ▶ Ranging between post-dive #5 and 4 days after the exposure, the four divers reported blurry vision

Results

Diver	Age	Eye Color	Pre-VA	Onset	Post-VA	Recover
A	33	Blue	20/30 20/25	Dive #5	Post +3 +4 +26 20/40 20/50 20/40 20/50 20/40 20/25 20/30 20/30	1 month
B	43	Blue	20/20 20/20	+4	+4 20/30 20/50	+10
C	41	Light Green	20/30 20/20	+3	Post +3 20/60 20/100 20/40 20/40	+10
D	44	Brown	20/16 20/16	Dive #5 (+2)	Post +3 20/16 20/30 20/16 20/16	+7

Conclusions

- ▶ Exposure was less than reported in other cases:
 - 1.35 ATM for 30 hours in 5 days (40.5 ATM-hrs)
 - Opposed to 1.3-1.6 ATM for 45-85 hrs (58.5 – 136 ATM-hrs)
- ▶ Pulse of exposure in wet divers when compared to hyperbaric oxygen therapies
- ▶ Exposure to oxygen in divers is a mixture of topical and systemic
- ▶ Myopia was self limited and all patients returned to baseline

Future Works

- ▶ What are risk factors for hyperoxic myopia?
- ▶ Is there a minimum required exposure to have hyperoxic myopia?
- ▶ Are wet divers more protected from hyperoxic myopia? Are they at higher risk?
- ▶ Does the type of rig matter? FFM vs. T-Bit vs. Helmet

Lenticular oxygen toxicity.

Schaal S, Beiran I, Rubinstein I, Miller B, Dovrat A.

Alberto Moscona Department of Ophthalmology, Rambam Medical Center, Haifa, Israel.

- ▶ Groups of **bovine** lenses treated with different combinations of oxygen and pressures
- ▶ The **higher the PO_2** and **longer the exposure**, the **more severe the changes**
- ▶ Centripetal orientation of lenticular changes
- ▶ Oxygen exposure at increase partial pressure plays some roll in lenticular changes

Phakic and pseudophakic eyes in patients during hyperbaric oxygen therapy.

Evanger K, Vaagbø G, Thorsen E, Haugen OH.

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- ▶ PO_2 2.4 atm
- ▶ 5 days a week, for 20 days, 90 min daily
- ▶ Phakic: 81% had >0.50 myopic shift
- ▶ Pseudophakic: NO myopic shift
- ▶ One patient, phakic/pseudophakic
 - Myopic shift of -1.12 D in the phakic eye
 - No change in pseudophakic eyes